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COMMON GROUND-LIVING SPIDERS IN OLD TAIGA FORESTS OF FINLAND

Seppo Koponen: Zoological Museum, University of Turku, FIN-20014 Turku, Finland

ABSTRACT. Spiders living on the forest floor in six old taiga forests were studied using pitfall traps in 1994 (in Suomussalmi) and 1995 (in Puolanka), central-eastern Finland, ca. 65° N. Seventy-seven species belonging to eleven families were caught. Linyphiidae (s. lat.) dominated both in species and individual numbers. The most common species were *Lepthyphantes alacris*, *Agyneta ramosa*, *Lepthyphantes antroniensis*, *Centromerus arcanus* and *Agyneta subtilis*. The fauna found is, in general, typical of old Finnish boreal forests.

The spider fauna of the boreal (taiga) forests in Finland has been studied by many authors. Basic studies were carried out by Huhta (1965, 1971). Investigations on spiders in old, primeval forests of Finland include, e.g., papers by Palmgren & Biström (1979), Biström & Väisänen (1988), Väisänen & Biström (1990), Niemelä et al. (1994) and Pajunen et al. (1995). These are all from more southern areas of Finland.

Figure 1.—The study areas in central-eastern Finland. 1, Suomussalmi; 2, Puolanka.

The spiders of taiga forests in central-eastern Finland have not been studied. The aim of this brief paper is to present the abundant species (of the early-midsummer period) on the floor in six old taiga forests. Some comparisons with previous studies will also be made.

These old forests are in the interests of the pulp and paper industry, and, on the other hand, there are plans to protect these areas. This study was supported by the Kainuu Park Area of the Finnish Forest and Park Service in order to provide some basic data for planning the use of these old forests. The data from the research in Suomussalmi have been partly published (Koponen 1995).

Table 1.—Percentage of Linyphiidae (s.lat.) of all specimens (A) and of all species caught (B).

Site	A	B
Suomussalmi:		
Luolakangas	95.1	85.0
Likoaho	93.3	72.9
Heinävaara	87.3	71.2
Puolanka:		
Paljakka	97.4	90.5
Kuirivaara	95.3	73.1
Siikavaara	84.1	74.2

Table 2.—Percentage of the ten most abundant species at Suomussalmi sites, 1994.

Site		Percent
Luolakangas	*Lepthyphantes alacris* (Blackwall 1853)	22.4
	L. antroniensis Schenkel 1933	21.7
	Centromerus arcanus (O.P.-Cambridge 1873)	11.1
	Diplocentria bidentata (Emerton 1882)	7.5
	Agyneta ramosa Jackson 1912	5.3
	Lepthyphantes tenebricola (Wider 1834)	4.6
	Latithorax latus (Holm 1939)	3.1
	Hilaira herniosa (Thorell 1875)	2.7
	Agyneta subtilis (O.P.-Cambridge 1863)	2.6
	Robertus lividus (Blackwall 1836)	2.4
Likoaho	*Agyneta subtilis* (O.P.-Cambridge 1863)	18.7
	Lepthyphantes antroniensis Schenkel 1933	18.7
	Agyneta conigera (O.P.-Cambridge 1863)	7.9
	A. ramosa Jackson 1912	7.6
	Lapthyphantes alacris (Blackwall 1853)	6.5
	Centromerus arcanus (O.P.-Cambridge 1873)	6.1
	Robertus lividus (Blackwall 1836)	5.4
	Lepthyphantes tenebricola (Wider 1834)	5.0
	Alopecosa pinetorum (Thorell 1856)	1.6
	Walckenaeria dysderoides (Wider 1834)	1.5
Heinävaara	*Agyneta ramosa* Jackson 1912	20.8
	Lepthyphantes antroniensis Schenkel 1933	13.8
	Agyneta subtilis (O.P.-Cambridge 1863)	11.2
	A. conigera (O.P.-Cambridge 1863)	10.3
	Lepthyphantes alacris (Blackwall 1853)	9.9
	Centromerus arcanus (O.P.-Cambridge 1873)	7.4
	Lepthyphantes tenebricola (Wider 1834)	5.5
	Robertus lividus (Blackwall 1836)	4.7
	Diplocentria bidentata (Emerton 1882)	3.6
	Hilaira herniosa (Thorell 1875)	1.2

STUDY AREA AND METHODS

The study areas are old, more or less natural primeval forests, surrounded by cutting areas and by young planted tree formations. The majority of large pines (*Pinus sylvestris*) and spruces (*Picea abies*) have a diameter of 35--45 cm. Dead standing and ground-lying trees are not very common. Field layer is mainly dominated by *Vaccinium vitis-idaea* and *V. myrtillus*, and the ground layer by the mosses of genera *Pleurozium*, *Dicranum* and *Hylocomium*. Elevation of the study sites varies between 160 and 270 m.

There were three study forests situating in the northern boreal forest zone (northern taiga) in Suomussalmi (1994) and three in Puolanka (1995), as follows (Fig. 1): *Suomussalmi* (64°45′N, 29°40′E): - Luolakangas: spruce-dominated, mosaic type (diversified) forest; - Likoaho: relatively dry, pine-dominated forest; - Heinävaara: pine-dominated, more moist than the two previous sites; *Puolanka* (65°N, 28°E): - Paljakka: spruce-dominated forest; - Kuirivaara: spruce-dominated, more moist than the two other sites in Puolanka; - Siikavaara: dry, pine-dominated mixed forest.

Pitfall trapping periods were 13 June–21 July 1994 in Suomussalmi and 14 June–2 August 1995 in Puolanka. The traps were plastic cups (mouth diameter 65 mm). Ethylene glycol with detergent was used as the preservation liquid, and the traps were provided with covers agaist rain and litter. Altogether, about 5600 identifiable spider specimens were collected. The material has been deposited in the Zoological Museum, University of Turku.

The usefulness of pitfall technique in spider studies has been discussed by many authors (e.g., Lowrie 1985). As pitfall data are not in-

Table 3.—Percentage of the ten most abundant species at Puolanka sites, 1995.

Site		Percent
Paljakka	*Lepthyphantes alacris* (Blackwall 1853)	33.1
	Centromerus arcanus (O.P.-Cambridge 1873)	22.3
	Agyneta subtilis (O.P.-Cambridge 1863)	7.8
	Macrargus rufus (Wider 1834)	7.4
	Agyneta ramosa Jackson 1912	5.6
	Lepthyphantes antroniensis Schenkel 1933	5.2
	Diplocentria bidentata (Emerton 1882)	3.4
	Hilaira herniosa (Thorell 1875)	3.0
	Cryphoeca silvicola (C.L. Koch 1834)	2.2
	Walckenaeria nudipalpis (Westring 1851)	1.9
Kuirivaara	*Lepthyphantes alacris* (Blackwall 1853)	44.1
	Centromerus arcanus (O.P.-Cambridge 1873)	19.3
	Agyneta subtilis (O.P.-Cambridge 1863)	5.0
	Macrargus rufus (Wider 1834)	4.0
	Agyneta ramosa Jackson 1912	3.7
	Asthenargus paganus (Simon 1884)	3.1
	Lepthyphantes antroniensis Schenkel 1933	3.0
	L. tenebricola (Wider 1834)	3.0
	Pardosa lugubris (Walckenaer 1802)	1.9
	Walckenaeria nudipalpis (Westring 1851)	1.6
Siikavaara	*Lepthyphantes alacris* (Blackwall 1853)	24.5
	Agyneta subtilis (O.P.-Cambridge 1863)	15.3
	A. ramosa Jackson 1912	13.8
	Zornella cultrigera (L. Koch 1879)	10.7
	Pardosa lugubris (Walckenaer 1802)	10.4
	Centromerus arcanus (O.P.-Cambridge 1873)	9.2
	Walckenaeria nudipalpis (Westring 1851)	4.0
	Lepthyphantes tenebricola (Wider 1834)	2.0
	Agyneta cauta (O.P.-Cambridge 1902)	1.7
	Lepthyphantes antroniensis Schenkel 1933	1.4

dicating real population densities, percentages (not individual numbers) are used here when comparing the sites.

RESULTS

Altogether 77 species were collected. Linyphiidae (s. lat.) clearly dominated in terms of both species and individual numbers (Table 1). This is typical of old, closed and shady forests. Other marked families were Lycosidae, Theridiidae and Gnaphosidae.

The ten most abundant species at each site are shown in Tables 2 and 3. These lists include 14 and 15 species at Suomussalmi and Puolanka sites, respectively. The dominant species in all forests in Puolanka was *Lepthyphantes alacris*, in Suomussalmi the dominants included *L. alacris*, *L. antroniensis*, *Agyneta ramosa* and *A. subtilis*. Non-linyphiids among the abundant species were *Pardosa lugubris*, *Robertus lividus*, *Alopecosa pinetorum* and *Cryphoeca silvicola*.

In Suomussalmi, three *Lepthyphantes* (*L. antroniensis*, *L. alacris*, *L. tenebricola*) and three *Agyneta* (*A. ramosa*, *A. subtilis*, *A. conigera*) species accounted for 65% of the total material. In Puolanka, *Lepthyphantes alacris*, *Centromerus arcanus*, *Agyneta subtilis* and *A. ramosa* formed 68% of the total material.

Only 14 of the 77 species caught were found in all studied six forests (Table 4). The most common (and evenly occurring) of these linyphiid species were *Lepthyphantes alacris*, *Agyneta ramosa*, *Lepthyphantes antroniensis*, *Centromerus arcanus* and *Agyneta subtilis*. Also the following species were found at all sites but in smaller numbers: *Macrargus rufus*, *Walckenaeria nudipalpis*, *Diplocentria bidentata*, *Tapinocyba pallens* (O.P.-Cambridge 1872), *Lepthyphantes tenebricola*, *Porrhom-*

Table 4.—Species found at all six forest sites; average rank = mean of species' abundance rank (e.g., *Lepthyphantes alacris*: 1st, 5th, 5th, 1st, 1st, 1st = 2.3).

Species	Average rank
Lepthyphantes alacris	2.3
Agyneta ramosa	3.8
Lepthyphantes antroniensis	4.0
Centromerus arcanus	4.2
Agyneta subtilis	5.5
Macrargus rufus	approx. 12
Walckenaeria nudipalpis	13
Diplocentria bidentata	15
Tapinocyba pallens	16
Lepthyphantes tenebricola	18
Porrhomma pallidum	20
Zornella cultrigera	22
Walckenaeria cuspidata	23
Hilaira herniosa	25

ma pallidum Jackson 1913, *Zornella cultrigera*, *Walckenaeria cuspidata* Blackwall 1833 and *Hilaira herniosa*.

DISCUSSION

The fauna found is relatively typical of Finnish boreal coniferous forests, i.e., taiga. Many of the abundant species have also been observed in old forests in previous studies in southern and central Finland. The northern location (ca. 65°N) of the study areas resulted in the occurrence of several northern species, along with the absence of some species with a more southern range. Väisänen & Biström (1990) listed the eight most abundant spiders found (however, collected with dry funnels) at Saarijärvi (62°50′N; about 300 km SW of the present study area) in central Finland. Of these eight species, only *Centromerus arcanus* was both abundant and common, six other species were found in smaller numbers and one was absent in the present material.

Some of the present abundant species have northern general range in Finland being rare or absent in earlier studies on old forest spiders carried out in more southern areas of southern or central Finland (e.g., Palmgren & Biström 1979; Biström & Väisänen 1988; Väisänen & Biström 1990; Niemelä et al. 1994; Pajunen et al. 1995). These include, e.g., *Lepthyphantes antroniensis*, *Latithorax latus*, *Zornella cultrigera* and *Hilaira herniosa*.

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